

AMENDMENTS TO THE CLAIMS

Upon entry of the present amendment, the status of the claims will be as shown below.

This listing of claims replaces all previous versions and listings of claims in the present application.

Listing of Claims

1. (Currently Amended) A spatial information detector ~~detecting device~~, comprising:
 - at least two photoelectric converters configured to receive a light from a target space, into which a light intensity-modulated at a modulation signal having a predetermined frequency is being irradiated, and generate an electric output corresponding to an intensity of the received light;
 - at least one electrode formed on each of said at least two photoelectric converters;
 - a charge storage ~~portion~~ formed in each of said at least two photoelectric converters by applying a control voltage to said at least one electrode to collect at least part of electric charges generated in said each of said at least two photoelectric ~~converter~~ converters;
 - a controller configured to control the control voltage applied to said at least one electrode such that an area of said charge storage ~~portion~~ in one of two different phase periods of said modulation signal is different from the area of said charge storage ~~portion~~ in ~~[[the]]~~ an other phase period of said modulation signal;
 - a charge ejector ~~ejecting portion~~ configured to output the electric charges collected in said charge storage ~~portion~~; and
 - an evaluator ~~evaluation unit~~ configured to evaluate the target space according to a difference between the electric charges collected in the one of said two different phase periods by said charge storage ~~portion~~ formed in one of said at least two photoelectric converters, and the

electric charges collected in the other phase period by said charge storage ~~portion~~ formed in the other one of said at least two photoelectric converters,

wherein said at least two photoelectric converters receive light from the target space, into which a flashing light is being irradiated, and

said evaluator evaluates the target space in accordance with a difference between electric charges collected in a lighting period of said flashing light by said charge storage formed in one of said at least two photoelectric converters, and electric charges collected in a non-lighting period of said flashing light by said charge storage formed in the other one of said photoelectric converters.

2. (Currently Amended) The spatial information detector ~~detecting device~~ as set forth in claim 1, wherein ~~said at least two photoelectric converters receive light from the target space, into which a flashing light is being irradiated,~~

said controller controls the control voltage applied to said at least one electrode such that the area of said charge storage ~~portion~~ in [[a]] the lighting period of said flashing light is different from ~~form~~ the area of said charge storage ~~portion~~ in [[a]] the non-lighting period of said flashing light, and

~~said evaluation unit evaluates the target space by use of a difference between the electric charges collected in the lighting period of said flashing light by said charge storage portion formed in one of said photoelectric converters, and the electric charges collected in the non-lighting period of said flashing light by said charge stored portion formed in the other one of said photoelectric converters.~~

3. (Currently Amended) The spatial information detector ~~detecting device~~ as set forth in claim 1, wherein said at least one electrode ~~[[is]]~~ comprises a plurality of electrodes, and said controller controls ~~[[the]]~~ a number of said plurality of electrodes, to which the control voltage is applied, thereby changing the area of said charge storage ~~portion~~.

4. (Currently Amended) The spatial information detector ~~detecting device~~ as set forth in claim 1, wherein said evaluator ~~evaluation unit~~ comprises an amplitude-image generator configured to generate an amplitude image having pixel values, each of which is provided by said difference.

5. (Currently Amended) The spatial information detector ~~detecting device~~ as set forth in claim 1, further comprising an amplitude-image generator configured to generate an amplitude image having pixel values, each of which is provided by said difference, and a gray-image generator configured to generate a gray image having pixel values, each of which is provided by one of amounts of electric charges collected in one of ~~[[a]]~~ the lighting period and ~~[[a]]~~ the non-lighting period of ~~[[a]]~~ the flashing light by said charge storage ~~portion~~, and an average of the amounts of electric charges collected in both of the lighting period and the non-lighting period by said charge storage ~~portion~~.

6. (Currently Amended) The spatial information detector ~~detecting device~~ as set forth in claim 2, wherein said controller controls the control voltage applied to said at least one electrode such that the area of said charge storage ~~portion~~ formed in each of said at least two photoelectric converters changes in synchronization with a flash timing of said flashing light.

7. (Currently Amended) The spatial information detector ~~detecting device~~ as set forth in claim 6, wherein said controller controls the control voltage applied to said at least one electrode of each of said at least two photoelectric converters such that the area of said charge storage ~~portion~~ formed in one of said at least two photoelectric converters is larger in the lighting period than the non-lighting period, and the area of said charge storage ~~portion~~ formed in the other one of said at least two photoelectric converters is larger in the non-lighting period than the lighting period.

8. (Currently Amended) The spatial information detector ~~detecting device~~ as set forth in claim 7, wherein said controller controls the control voltage applied to said at least one electrode of each of said at least two photoelectric converters such that the area of said charge storage ~~portion~~ formed in one of said at least two photoelectric converters in the lighting period is equal to the area of said charge storage ~~portion~~ formed in the other one of said at least two photoelectric converters in the non-lighting period.

9. (Currently Amended) The spatial information detector ~~detecting device~~ as set forth in claim 4, further comprising a characteristic-amount extractor ~~extracting portion~~ configured to extract a characteristic amount of an object in said target space according to said amplitude image generated by said amplitude-image generator, a similarity calculator ~~calculating portion~~ configured to calculate a degree of similarity ~~between~~ by comparing said characteristic amount with a previously prepared template, and a target recognizer ~~recognizing portion~~ configured to

recognize said object as a target object corresponding to said template when the degree of similarity is not smaller than a predetermined value.

10. (Currently Amended) The spatial information detector ~~detecting device~~ as set forth in claim 9, wherein said object to be detected is a face, and the spatial information detector ~~detecting device~~ further comprises a template storage ~~storing portion~~ configured to store a face template previously prepared according to characteristic amounts of said face, and said ~~object~~ target recognizer ~~recognizing portion~~ recognizes said face as a person corresponding to said face template when the degree of similarity between said characteristic amount extracted by said characteristic-amount extractor ~~extracting portion~~ and said face template stored in said template storage ~~storing portion~~ is not smaller than the predetermined value.

11. (Currently Amended) The spatial information detector ~~detecting device~~ as set forth in claim 4, further comprising a saturation determiner ~~determining portion~~ configured to compare a predetermined threshold value with amounts of electric charges collected in at least one of said two different phase periods of said modulation signal by said charge storage ~~portion~~, and an output regulator ~~regulating portion~~ configured to regulate an electric output corresponding to the intensity of received light according to a [[the]] comparison result.

12. (Currently Amended) The spatial information detector ~~detecting device~~ as set forth in claim 11, wherein said output regulator ~~regulating portion~~ reduces the electric output of [[said]] a photoelectric converter when the amounts of electric charges are greater than the threshold value.

13. (Currently Amended) The spatial information detector ~~detecting device~~ as set forth in claim 4, further comprising a saturation determiner ~~determining portion~~ configured to compare a predetermined threshold value with amounts of electric charges collected in at least one of said two different phase periods of said modulation signal by said charge storage ~~portion~~, and wherein said evaluator ~~evaluation unit~~ evaluates the target space by use of a preset difference value in place of said difference when the amounts of electric charges are greater than the threshold value.

14. (Currently Amended) The spatial information detector ~~detecting device~~ as set forth in claim 4, further comprising a saturation determiner ~~determining portion~~ configured to compare a predetermined threshold value with amounts of electric charges collected in each of said two different phase periods of said modulation signal over a storing time period corresponding to a plurality of cycles of said modulation signal, and an output regulator ~~regulating portion~~ configured to regulate an electric output corresponding to ~~[[the]]~~ an intensity of received light by changing the storing time period according to a ~~[[the]]~~ comparison result.

15. (Currently Amended) The spatial information detector ~~detecting device~~ as set forth in claim 4, further comprising a saturation determiner ~~determining portion~~ configured to compare a predetermined threshold value with amounts of electric charges collected in each of said two different phase periods of said modulation signal over one cycle of said modulation signal, and an output regulator ~~regulating portion~~ configured to regulate an electric output corresponding to

[[the]] an intensity of received light by changing a duration of at least one of said two different phase periods according to a [[the]] comparison result.

16. (New) A spatial information detector, comprising:

a light source that irradiates a flashing light intensity modulated at a modulation signal having a predetermined frequency into a target space;

an image sensor comprised of a semiconductor substrate and at least two light receivers arranged on the semiconductor substrate, each of the at least two light receivers comprising:

a photoelectric converter configured to receive the flashing light from the target space to generate an electric output corresponding to an intensity of the received light;

electrodes formed on the photoelectric converter;

a charge storage induced in the photoelectric converter by a control voltage applied to all or part of the electrodes so as to collect at least part of electric charges generated in the photoelectric converter; and

a charge ejector configured to output the electric charges from the charge storage;

and

a microcomputer comprising a control circuit and an evaluator, said control circuit being configured:

to generate each control voltage;

to adjust a ratio of the electric charges collected in the charge storage;

to adjust a timing of forming the charge storage; and

to adjust a timing of outputting the electric charges from the charge ejector;

said evaluator being configured to detect spatial information from the target space,

wherein said evaluator is configured to evaluate the target space by use of a difference between the electric charges collected in a lighting period of said flashing light by said charge storage formed in a first photoelectric converter, and the electric charges collected in a non-lighting period of said flashing light by said charge storage formed in a second photoelectric converter.